Bionomics of *Micronecta scutellaris* Stål.[1]

MUKHTAR AHMAD[2] AND NAWAB H. KHAN[3]

(*With three text-figures*)

Micronecta scutellaris Stål., is commonly found in stagnant water of ponds, lakes and streams in India and can be commercially used as cage bird and poultry feed. During the present studies bionomics of *M. scutellaris* was studied at different temperatures and the effects of various food materials on the oviposition of the species have also been investigated.

INTRODUCTION

Members of the family Corixidae comprising over two hundred species of waterboatmen are voracious feeders on a wide variety of plankton and can injest detritus from the bottom ooze. They are world wide in distribution and are commonly found in ponds, lakes, streams and rivers and even in some brackish waters (Butler, E.A. 1923). They occur from below sea-level to an elevation of about 15,000 feet in the Himalayas (Usinger 1956) and are equally adapted to cold waters of the sub arctic and the warm waters of the tropics.

A species commonly found in stagnant waters in India is *Micronecta scutellaris*. It can be used as cage bird and poultry feed and therefore an attempt has been made to study its bionomics and to find out if it can be bred for commercial purposes.

METHODS AND MATERIALS

Adults of *M. scutellaris* were collected from Nilichhattri and Jamalpur ponds located in the vicinity of the University campus. The bugs were kept in batches of fifty to hundred in glass trough, 33 cm in diameter × 13 cm in height and having a 2·5 cm thick layer of sand at the bottom. The troughs were filled with pond water upto a height of 4 to 6 cm and aquatic plants such as *Hydrilla* sp. and also bottom ooze from a natural pond and decaying organic matter from a drain were added to the container. Water and the decaying organic matter were changed after every 24 hours in order to provide the insects with fresh nourishment. Oviposition readily occurred on the stems and leaves of the submerged plants and parts of the plants bearing the eggs were transferred to glass beakers containing water for the hatching of the eggs.

Oviposition

The eggs of *M. scutellaris* are usually laid on the roots, stems and leaves of *Hydrilla* sp., *Marselia* sp. and other aquatic plants.

If however no suitable host plant is available, the eggs may be deposited on pieces of wood or stones in the vicinity of water. They are deposited singly or linearly arranged in groups without any definite structural pattern. While depositing an egg the female grasps a leaflet or a portion of the plant selected for oviposition with its fore and middle pairs of legs, and then with a longitudinal motion of the abdomen, the tip resting on the spot, deposits an egg and

[1] Accepted October 1975.

[2] Research Scholar, Dept. of Zoology, A.M.U., Aligarh.

[3] Professor, Dept. of Zoology, A.M.U., Aligarh.

swims away. We were successful in obtaining eggs on filter papers which were placed along the edges of the glass troughs. The temperature of the water was kept at 21 ± 1°C.

Nothing is known concerning the duration of the preoviposition and oviposition periods in this insect and hence single pairs of freshly emerged adults of *M. scutellaris* were kept in small 250 cc beakers at 21 ± 1°C. The preoviposition period varied from 3.0 to 11.0 days, while the oviposition period lasted from 7 to 12 days, a single female laying a total of 69 to 163 eggs. More than 60 per cent of the total number of eggs were deposited during the first five days of the oviposition period.

Eggs

The oval whitish eggs measure from 0.45 to 0.49 mm in length and 0.11 to 0.19 mm in width and bear short tubular projections on their dorsal surfaces (Figure 2A).

Effect of temperature on the hatching of the eggs

Batches of fifty freshly laid eggs were placed in three different beakers of 250.0 ml capacity each and filled with water. The temperature of the water was maintained in each at 18.2°, 24.0° and 31.0°C respectively and the eggs were examined at twelve hour intervals to determine the rate of their hatching. These observations proved that the temperature does affect

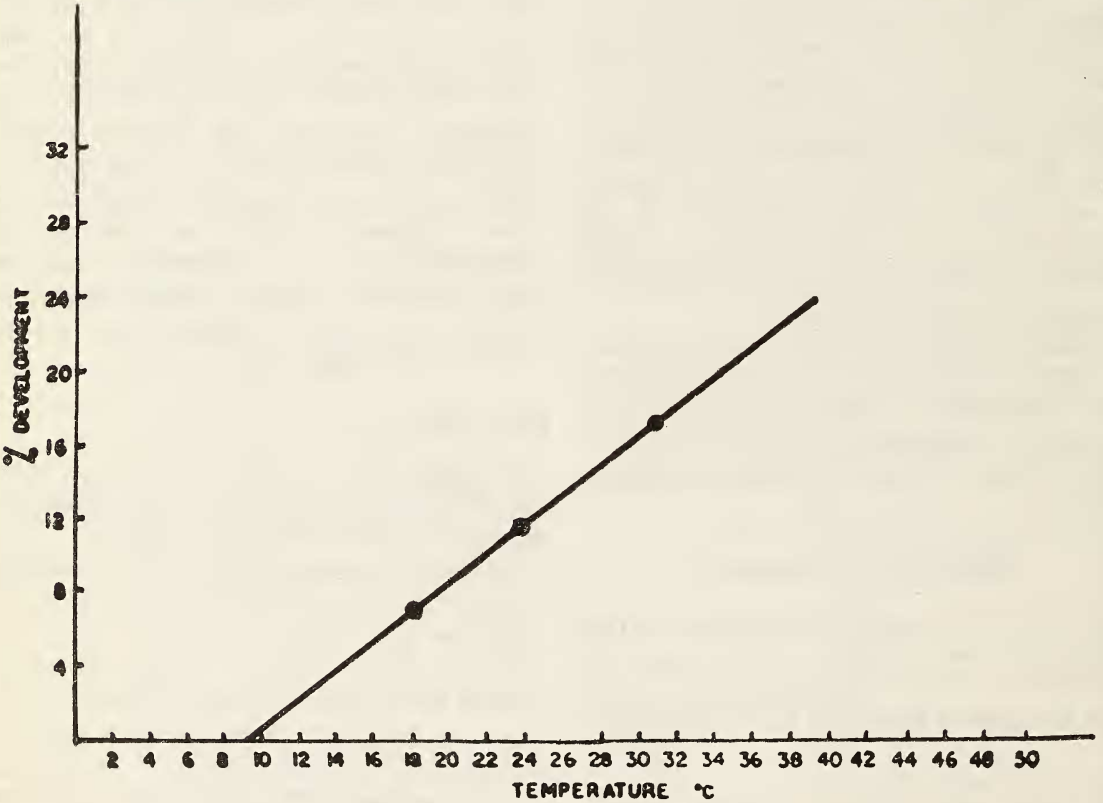

Fig. 1. Effect of temperature on the development of eggs.

the hatching of the eggs. At 18.2°C only 5.2 per cent eggs hatched and at 31.0°C, 58.1 per cent as compared to 78.0 per cent hatching observed at 24.0°C. This shows that temperatures below 20.0°C and above 30.0°C are unfavourable for the hatching of the eggs of *M. scutellaris.* Temperature of about 24.0°C seem to be more favourable for hatching as at this temperature the hatching of the eggs was found to be the maximum. That the duration of the egg stage is also affected by the temperature is clear as seen in figure 1. It was 14.2, 8.7 and 5.9 days at 18.2°, 24.0° and 31.0°C respectively, showing thereby that the incubation period decreases with an increase in temperature. The threshold temperature for the development of the eggs as established by figure 1 lies at 9.4°C, the value of K as determined by the following formula (after Chapmen, 1931) being :

$$Y\,(X - a) = K$$

where Y = incubation period in days at temperature X

a = threshold temperature

X = Temperature at which K is to be determined.

K = constant

The values at different temperatures were

18.2°C = 127.60

24.0°C = 127.07

31.0°C = 127.44

The values of K at the three temperatures are almost similar, so that the theoretical threshold temperature as determined above seems to be correct.

Nymphs

Fernando & Leong (1963) successfully reared the nymphs of *Micronecta quadristrigata* in open glass troughs filled with water and containing some bottom ooze from the ponds.

During the present studies the nymphs of *M. scutellaris* were reared individually as well as collectively on decaying organic matter. Eggs were collected from the leaves and stems of the *Hydrilla* plant and were allowed to hatch. The first instar nymphs were kept singly in glass beakers of 250 ml capacity and filled with pond water upto a height of about four centimetres. Water was changed after every 24 hours. The nymphs were also reared collectively in glass troughs as described in methods above.

There were five nymphal instars, the existence of which was checked by applying the formula of Dyar (1890). The ratio of increase in each instar was obtained by dividing each observed width of the head with that of the preceding

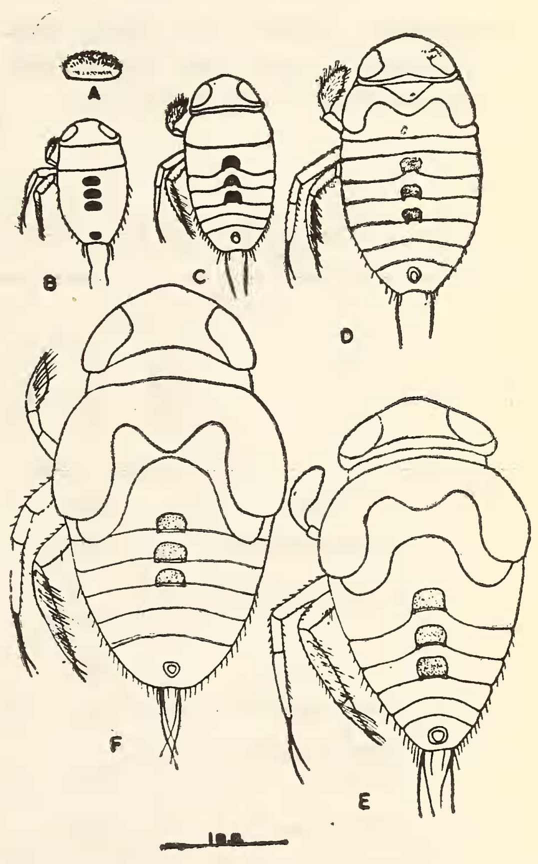

Fig. 2. Egg and developmental stages, of *M. scutellaris.*

A. Egg ; B. First instar ; C. Second instar ; D. Third instar ; E. Fourth instar ; F. Fifth instar.

instar. The average of such ratios came to 1.31. By using this ratio as a factor, the width of the head of the various instars was calculated and found to be :

Instar		Observed width	Calculated width
First	..	0.42 mm	0.42 mm
Second	..	0.69 mm	0.55 mm
Third	..	0.88 mm	0.72 mm
Fourth	..	1.07 mm	1.00 mm
Fifth	..	1.19 mm	1.31 mm

The calculated widths do not depart considerably from the measured ones showing thereby that no ecdysis had been overlooked.

Effect of temperature and food on the duration of the nymphal period

This effect was studied by rearing lots of 50 nymphs each at 18.0°, 24.0° and 32.0°C. They were fed on yeast powder, *Spirogyra* filaments or decaying organic matter from the drains.

The first instar nymphs when kept at 18.0°C failed to develop any further and died within eight hours of hatching. The nymphs reared at 24.0° and 32.0°C however completed their development when fed on decaying organic matter from the drains. Those reared on yeast powder and *Spirogyra* filaments survived only upto the second and the fourth instars. The development per day of the various instars accelerated with a rise in temperature (Table 1).

TABLE 1

EFFECT OF TEMPERATURE AND FOOD ON THE DEVELOPMENT OF THE NYMPHS OF *M. scutellaris*

Temperature (°C)	Fed on	I Instar		II Instar		III Instar		IV Instar		V Instar		Total nymphal duration (days)
		Duration (days)	% Mortality	Duration (days)	% Mortality	Duration (days)	% Mortality	Duration (days)	% Mortality	Duration (days)	% Mortality	
18.0	Yeast powder	..	100.0	..	..	..	..	..	..	..	..	..
	Spirogyra filaments	..	100.0	..	..	..	..	..	..	..	..	..
	Decaying organic matters	..	100.0	..	..	..	..	..	..	..	..	..
24.0	Yeast powder	8.0	80.0	..	20.0	..	..	..	..	..	..	..
	Spirogyra filaments	7.5	60.0	8.0	20.0	6.5	10.0	..	10.0	..	..	..
	Decaying organic matters	7.5	20.0	6.0	15.0	6.0	15.0	6.5	10.0	6.0	10.0	32.0
32.0	Yeast powder	7.0	90.0	..	10.0	..	..	..	..	..	..	..
	Spirogyra filaments	7.0	50.0	6.0	30.0	6.5	10.0	..	10.0	..	..	..
	Decaying organic matters	7.0	30.0	5.5	20.0	5.0	10.0	6.0	10.0	5.0	10.0	28.5

The different nymphal instars may be identified with the help of the following key :

1. Wingpads absent (Fig. 2-B & 2-C) ; antennae indistinct ; hind tibiae with few short hairs ; middle legs without setae ; body length less than 2 mm 2
— Wingpads present (Fig. 2-D, F ; 3-A) ; antennae distinct (Figure 3-B, E) ; hind tibiae with numerous long hairs ; middle legs with setae ; body length more than 2 mm 3
2. Abdominal segments not clearly demarcated ; dorsal abdominal gland openings indistinct ; body length less than 1 mm (Fig. 2-B)...... *1st instar*
— Abdominal segments clearly demarcated ; dorsal abdominal gland openings clearly distinct ; body length more than 1 mm (Fig. 2-C).... *2nd instar*
3. Wingpads well developed (Figures 2-E, F ; 3-A) ; antennae two segmented ; basal segment distinct ; apical segment much broad or club like (Figures 3-C, E) ; body length more than 2.5 mm........ 4
— Wingpads rudimentary (Figure 2-D) ; antennae unsegmented ; long and finger like ; body length less than 2.5 mm .... *3rd instar*
4. Wingpads extending beyond posterior margin of thorax (Figures 2-F, 3-A) ; antennae with basal segment well developed (Figures 3-D, E) 5
— Wingpads not extending beyond posterior margin of thorax (Figure 2-E) ; antennae with basal segment very narrow and contiguous with the broad apical segment (Figure 3-C)............ *4th instar*
5. Wingpads not extending beyond mid of abdomen (Figure 2-F) antennae with basal segment transverse and contiguous with broad apical segment (Fig. 3-D)........................ 5th *instar*
— Wings well developed extending upto apex of abdomen (Figure 3-A) ; antennae with basal segment as long as wide and clearly separated from club shaped apical segment (Figure 3-E)........ .... Adult.

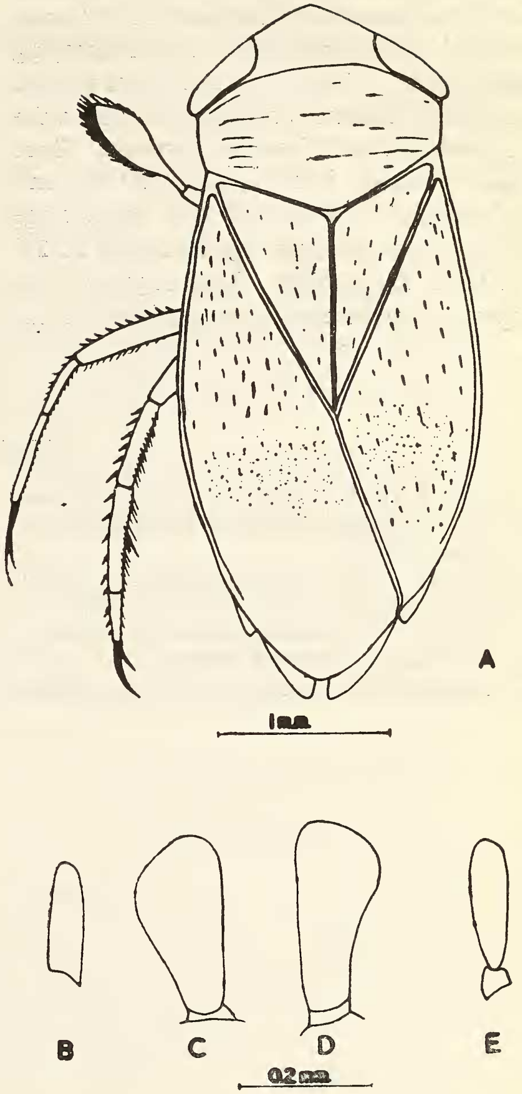

Fig. 3. A. *M. scutellaris*—Adult ; B. Antenna of third instar ; C. Antenna of fourth instar ; D. Antenna of fifth instar ; E. Antenna of adult.

SUMMARY

Micronecta scutellaris is generally found in stagnant waters of ponds, pools and the lakes and deposits its eggs on the roots, stems and leaves of *Hydrilla* sp., *Marselia* sp. and other aquatic plants. The preoviposition period varies from 3.0 to 11.0 days and a female lays 69 to 163 eggs over a period of 7.0 to 12.0 days. The incubation period is greatly affected by temperature conditions and the threshold temperature for the development of the eggs lies at 9.4°C. A temperature of 24.0°C seems to

be most suitable for the hatching of the eggs. The nymphs reared at 24.0° and 32.0°C completed their development when fed on decaying organic matter. Those reared on yeast powder and *Spirogyra* filaments survived only upto the second and the fourth instar respectively. There are five nymphal instars. Only 30.0% and 20.0% nymphs could reach the adult stage when reared on decaying organic matter at 24° and 32.0°C respectively. This suggests that the species can be reared successfully on the decaying organic matter at temperatures varying between 24.0° and 32.0°C.

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